

**REPORT ON
THE COSTS AND BENEFITS OF STATE AND LOCAL
OPTIONS TO STIMULATE AN INCREASE IN
THE RECYCLING OF PLASTICS**

**Prepared by the
Maine State Planning Office**

for the

**Joint Standing Committee on Natural Resources
of the 124th Legislature**

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EXECUTIVE SUMMARY

This report is intended to provide both an overview of plastic container recycling efforts currently underway in Maine's municipalities and offer possible options that could be adopted to increase the capture and recycling of plastic containers. Data used in this report is from 2006 and 2007, the most current 'complete year' data available.

The earliest broad-based plastic recycling program in the state resulted from the operation of the state's 'Bottle Bill', where empty beverage containers, including plastic containers, are redeemed for monetary value and the beverage industry processes and markets those containers to the plastic reclaimers.

Today, nearly all of Maine's municipally offered recycling programs include plastic container recycling, typically, the high density polyethylene (HDPE) resin, either of the un-pigmented (natural) resin or pigmented resin. Many programs also collect polyethylene terephthalate (PET) containers. The 'single stream' or 'single sort' recycling collection programs, adopted by approximately 50 communities, accept 'all plastic containers' and the processing facilities sort the containers by resin type. In addition, a few municipal programs include 'bulky' or other plastics not classified as 'containers'.

In examining possible options to increase the recovery and ultimate recycling of plastic containers, it is critical to understand that the used plastic containers are actually a commodity. While the scrap plastic is desired by the markets, and though the adoption of varying state and local actions can affect the supply of scrap plastic, the markets do dictate the demand for that scrap. Historically, the state has encouraged recycling of materials and products for which there are known markets, and plastic is such an example. Municipalities were encouraged to begin adding plastic to their recycling programs in the late 1980's and plastic containers became a common material in the emerging programs in the early 1990's. Collection of plastics has been problematic, due to the light weight of the containers and the volume of space they occupied. In addition, the resident needs to properly rinse the container prior to placing in the recycling bin.

Current plastic recycling incentives include: adoption of a 'pay as you throw' program, where residents pay the cost of collection and disposal of trash, but not recyclables; adoption of mandatory recycling, which has been done by many communities, but enforcement is quite variable; and the adoption of 'single sort' or 'single stream' recycling, where all plastic containers are accepted for recycling.

In reviewing the potential costs and benefits of recycling an increased volume of plastics, the actual expenses of adding additional types of plastics could not be readily extracted from the recycling program data available, since recycling collection and processing is largely performed as a single activity, and not separated by recyclable item or product. However, in examining the gross numbers of recycling programs, of collection and processing expenses, the costs of recycling were similar to the costs of managing the solid waste of the community, on a ton to ton comparison. However, when factoring in the revenue received from the sale of recyclables, recycling can be provided at a lower cost than disposal of that material as a solid waste.

BACKGROUND ON THE REQUEST FOR THIS REPORT

During the 123rd Legislative session, a draft version of LD 810, “An Act to Improve Solid Waste Management”, contained a directive to have the State Planning Office and the Department of Environmental Protection “conduct a review of the costs and benefits of state and local government options to stimulate an increase in the recycling of plastics, and report the findings and recommendations to the Committee in the next session. The types of plastics proposed to be studied include plastic bottles and rigid containers, numbered 1 through 7.”

During Committee discussion of LD 810, even though there was a sense from the members that this review could be valuable, there was a reluctance to include the review in the final version of the bill. SPO agreed to undertake the review. The letter sent by the Committee to State Planning is found in Appendix A.

For further explanation of the types of plastics included in this report, Appendix B provides a description of the plastic resins ‘1’ through ‘7’ used in today’s packaging as well as information on their properties, applications and what products they may be recycled into.

OVERVIEW OF CURRENT PLASTIC CONTAINER EFFORTS RESULTING FROM THE MAINE 'BOTTLE BILL' REDEMPTION PROGRAM

One of the more visible plastic container recovery efforts is that of the Maine beverage container redemption program, more commonly referred to as 'the bottle bill'. Enacted on November 2, 1976, and implemented in January 1978, many of the beverage containers sold in Maine have carried a redemption value, typically five cents. The Maine Department of Agriculture, through its Division of Quality Assurance and Regulations, administers the bottle bill.

In the beginning of the program, soda and beer products were covered by the program but during the 1980's, the program was expanded to include wine coolers and then juice, water, sports drinks, certain ciders, wine and spirits. Maine is one of the eleven states in the United States with a bottle bill program, and has one of the broadest 'bottle bill's in effect.

To manage the hundreds of thousands of beverage containers redeemed daily, both retailers and independent redemption centers accept the empty containers and provide the redemption value of the container to the bearer of the containers. Approximately 810 such locations are in operation across the state. These facilities accept glass, aluminum, tin and plastic containers for redemption, with the containers then being processed and recycled by material category. This system of beverage container management provides for the recovery of thousands of tons of glass, metal, plastic and associated materials each year.

In 2007, the Department of Agriculture was directed, through Resolve Chapter 40, to "Estimate the Annual Value of Uncollected Bottle Deposits, Fraud and Total Costs under Maine's Bottle Bill." Part of the effort in completing that report included gathering beverage container sales information. Nearly 650,000,000 beverage containers were reported as being sold through retail outlets in 2006. The numbers obtained by the Department do not include the material category for these containers but viewing the product shelves in markets, if conservatively one-third of the beverage containers are plastic, then the bottle bill encouraged the redemption (and recycling) of over 215,000,000 containers (if all containers were redeemed) in 2006.

A LOOK AT COMMUNITY PLASTICS RECYCLING SYSTEMS

Across the country, most community recycling programs include at least one type of plastic. Which plastics are actually accepted for recycling can vary widely from program to program. HDPE and PET are the most widely accepted plastics in community recycling programs because they make up nearly 95% of all plastic bottles found in the residential waste stream and there are well-established recycling markets for these bottles.

In recent years, community efforts to improve recycling economics have resulted in a variety of innovative collection methods. These collection methods include, Pay-Per-Bag (or Pay As You Throw – PAYT), dual stream collection, and single stream collection programs. The focus of each of these methods is to increase recovery rates and improve on recycling economics. As these methods have strived to make recycling easier for the consumer, the consumer has responded with a desire to recycle more materials—including more plastics.

The Plastics Division of the American Chemistry Council (formerly the American Plastics Council) developed the “all plastic bottles” collection program strategy as a way to increase the recovery of HDPE and PET bottles in response to the Association of Post-Consumer Plastic Recyclers’ request for increased recovery of these two commodities. Many communities that have switched to dual stream, single stream and PAYT collection programs have also transitioned to “all plastic bottles” collections. The result has been increased recovery of HDPE and PET bottles with minimal or no cost increases.

Visit this website to learn more about “All Plastic Bottle Programs”
<http://www.allplasticbottles.org/>

Although most communities found that they received no increase in plastics that were not targeted for recycling, the new collection programs brought consumer attention to the amount of other plastic containers in the residential waste stream. Consumers, wanting to do the ‘environmentally correct thing’, responded to municipal programs by requesting to recycle ‘more plastics’. As a result some communities have expanded their plastics collections to include all plastic containers (often with some size limitations). Many MRFs (material processing facilities) or other processing facilities have begun sorting and baling these additional containers for marketing to emerging domestic markets or overseas markets. (See *Resource Recycling*, “Plastics Recycling Update” November 2008, ‘Recycling more than plastic bottles.’)

Communities in other Northeast states have successfully added and marketed all rigid plastic containers (expanding collection beyond just ‘bottles’, which are containers with ‘necks’) or some mix of rigid plastic containers. In most cases, recycling managers reported that their residents wanted to recycle more plastic and they were able to identify a market that would take the material baled. One community even stated “Even if we receive no revenue for [it] (mixed plastic containers), it is still more economical than disposal and we would continue to collect and recycle all plastic containers”.

The recent high cost of oil and corresponding high cost of virgin plastic resins prompted increased activity to develop recycling programs for these additional containers that are easily obtainable through the established recycling collection infrastructure. This continuing market development shows promise for the future of plastic recycling outside the arena of HDPE and PET bottle recycling.

OVERVIEW OF MUNICIPAL RECYCLING PROGRAMS THAT INCLUDE PLASTIC CONTAINERS

Background

Maine municipalities are responsible for providing solid waste disposal and recycling services to their residents and commercial entities. Recycling became a strongly encouraged municipal activity in the late 1980's and early 1990's, resulting in the establishment of over 300 municipal programs using nearly 145 processing facilities to prepare the recyclables for market.

The first products to be included in recycling programs were newsprint, corrugated cardboard, mixed paper, glass and tin cans. Over time, that increased and included plastic bottles. Primarily, the High Density Polyethylene (HDPE) bottles (containers with 'necks') were collected with some differentiation. HDPE plastic containers constitute the highest component of plastic containers in the municipal solid waste stream.

Milk containers are made from a 'natural' HDPE resin and contain no added pigment (except those marketed as 'light block' or other term where titanium dioxide has been added to the resin to reduce the impact of ultra-violet light on the milk inside the container). Other HDPE containers such as laundry detergent bottles, coffee 'cans', some juice containers and others have pigments added. These containers may be collected and marketed with the 'natural' HDPE or marketed as a separate material. Plastic containers are typically 'baled' for marketing.

Value of these plastics varies, as recyclables are a commodity, but bales of 'natural' HDPE usually command a higher price than the bales of pigmented HDPE containers. 'Natural' HDPE containers are readily available in the waste stream. 'Natural' HDPE easily accepts the addition of color additives when desired. The recycled resin is in higher demand by a variety of product manufacturers. All of these reasons contribute to the higher price usually offered for 'natural' HDPE bales. HDPE plastic container recycling has been supported by residents and has not been a major issue for the municipal recycling program to manage, as the containers bale easily with proper equipment.

In addition to the HDPE containers, many municipal recycling programs also collect and process Polyethylene terephthalate (PET) plastic containers. These are typically clear (not necessarily free of pigment) and include soda bottles, cooking oil, snacks and other products. However, PET resin possesses a strong 'memory ability', making baling of these containers more of a challenge for many municipal programs. In the early days of recycling, most PET containers consisted of beverage bottles, and were recovered through the deposit system in Maine. This fact, coupled with the relatively small amount of 'other' PET containers in the waste stream when plastic recycling began, did not result in widespread adoption of PET container recycling by Maine municipal recycling programs.

Maine Community Plastic Recycling Efforts

In Maine, almost all residents have access to HDPE bottle recycling. Many communities collect PET bottles and a few collect 'other rigid plastic containers' for recycling. (Refer to Appendix C for a listing of reported plastic recycling efforts by Maine's communities).

Since Maine has expanded beverage container deposit legislation in place, it is likely that most plastic beverage bottles are being recovered through the redemption system. In recent years, PET has also become a popular resin choice for bottles and containers used to package food and non-food products such as peanut butter, mayonnaise, ketchup, salad oils, shampoo, liquid soaps, dish washing soaps, cleaning products and other food and non-food products.

Because these additional PET bottles and containers are not covered by the Maine bottle deposit program, if a community does not collect PET for recycling, they are more than likely being thrown away with household trash and either landfilled or incinerated. A few communities collect and bale PET containers. Since non-bottle PET is only 20-25% of the residential PET stream, these communities do not generate that much material annually. They ship the PET bales along with their HDPE bales through an arrangement with the HDPE processor. The HDPE processor will eventually ship them to a PET reclaimer when they have generated enough for a truckload of only PET bales. Under this type of arrangement, the price paid for the PET bales is much lower than if a full truckload were shipped directly to a PET reclaimer. Although there is a ready market for PET, the labor, storage needs and low price paid for less than a truckload of bales are often factors that discourage communities from targeting PET for recycling.

Other Rigid Container Recycling

Ecomaine, (a non-profit waste management company owned and operated by 21 municipalities in Southern Maine) opened a single-sort recycling processing facility in Portland in 2007. Single sort recycling is a collection system where all fiber products and container recyclables are placed in a single container and delivered to a MRF for sorting and processing for sale to market. Portland and other member communities of ecomaine are collecting not only HDPE and PET bottles but also all other rigid plastic containers as part of their recycling program. To date the rigid plastic container material has been successfully marketed to processors outside the United States. As new markets develop, there could be more opportunities to deliver the material domestically.

FCR Goodman (the recycling division of Casella Waste Systems Inc.) also offers a 'single stream' recycling program to many of the municipalities it services, with processing done at their Auburn, Massachusetts, MRF. The single stream and single sort collection programs are similar, just with different names. Additional communities that are recycling rigid containers include Andover, Brunswick, Falmouth, Freeport, Limerick, Scarborough and South Berwick. Both operations are actively inviting additional communities to join in these collection programs, so there may be additional communities coming on line that include all rigid plastic containers in their recycling mix.

In the current economy, a number of communities are considering the single stream approach as it eliminates labor costs to sort and bale individual plastic streams such as HDPE and PET. Although there is still revenue to be gleaned from bales of HDPE and PET, without looking closely at each individual recycling program it is difficult to see if single stream collection and marketing could improve the economics of any particular recycling program. However, programs that collect 'all bottles' do report higher recovery rates of HDPE and PET containers, due to the simple fact that when all plastic bottles are included in a recycling program, more HDPE and PET containers are provided to the program, bringing in additional revenue without adding significantly to processing costs. Often, whether to expand recycling programs becomes more of a question of whether a community wishes to recycle more material or glean higher revenue from a more labor-intensive process of sorting and baling individual streams of plastic.

Municipal recycling programs that include other types of plastics

Other Plastic Recycling

Some communities in Maine are collecting bulky plastic waste, such as plastic toys, wading pools, 5 gallon pails, and other plastic products, to increase their recovery of waste plastics. St. George and Readfield are two of these communities collecting this material. Although this market is variable at best in a good economy (mostly only export markets exist for this type of plastic) collection criteria are very specific and consolidation requirements to meet export container specifications are equally stringent. Just as domestic markets do not want garbage, export markets do not want it either.

Recent exporting regulations put the pressure on exporters to meet the qualifications for material entering foreign markets and stiff fines can be the result of sending material that does not qualify as clean secondary material. In the slumping world economy the export market demand is depressed as well, due to the fact that no one is buying goods.

OVERVIEW OF THE MARKETS FOR PLASTICS

Plastics Markets Overview

Plastic bottles were one of the later post-consumer recycling markets to be developed, prompted by the rapid switch from glass to plastic for many beverages in the seventies and subsequently food and cosmetic products in later years. In the mid-late 1980s, a few communities were just beginning to collect HDPE and PET bottles for recycling. Milk and soda were being bottled in plastic and discarded bottles were being generated at a rate that proved critical mass for developing a recycling industry.

At the start of plastic bottle recycling, the prices paid for collected bottles were quite low compared to the prices that have been paid in the past few years. It took time for the industry to fully develop as well as end product manufacturers to become familiar with recycled resin and comfortable using it in manufacturing product. After many growing pains, the industry matured. It took time for plastics recycling to reach the point of being able to reliably provide recycled resin of consistent quality and quantity to meet the needs of product manufacturers.

Over the years the HDPE and PET recycling industry have become well established in the United States and abroad. The recycling industry is probably a purer form of capitalism than any other industry. There are no subsidies for plastic recycling and commodity pricing is very closely tied to supply and demand. When demand is high, and/or available supply short, prices paid for baled bottles is higher and when the opposite is the case prices are lower - - much like what is happening now with a slow economy, products that utilize recycled HDPE and PET are not in high demand. The result is an over supply of recycled resin, full warehouses of baled bottles and low purchasing prices for feedstock. Even the export market is sluggish, which historically has been an outlet for material when domestic demand is low.

It is important to remember that even though the prices paid for plastics have taken a sharp decline in the past month or two, as the economy recovers, recycling commodity prices will also recover. Even though prices paid for recycled plastic are much lower than in previous years, it still makes economic sense to continue to recycle plastic for at least two reasons. One, it currently costs more to landfill or incinerate plastic in Maine, and two, the viability of the plastic recycling industry is dependent on supply to remain stable. It is much harder to regenerate a supply chain once it has been stopped

Recycling 'More Than Bottles'

In addition to milk and beverages, an increasing number of food products and cosmetic products are now packaged in plastic bottles and containers. Plastic weighs less than glass, steel or aluminum, and in most instances this material substitution results in more product being delivered for less cost due to lighter weight packaging. These additional plastic containers subsequently end up in the waste stream. Due to increase environmental awareness, consumers are interested in recycling these containers as well.

In an effort to recover more HDPE and PET bottles to feed the domestic plastics recycling industry, the American Plastics Council promoted "All Plastic Bottles" collection programs. Since HDPE and PET make up 95 percent of the plastic bottle stream, by collecting all bottles, more HDPE and PET bottles would be recovered. This proved to be true in all communities that incorporated the "all bottles" program. (Visit the website www.allplasticbottles.org for more details). Appendix D is the plastics section of the United States Environmental Protection Agency's '2007 Characterization of Municipal Solid Waste, by Weight, which provides a detailed analysis of how and which plastic resins are found in the waste stream. This will provide the reader with a perspective on the role of plastics in product manufacture and distribution, and on managing these plastics at the end of their intended use.

With the proliferation of 'Pay As You Throw' and single stream collection programs, consumers and processors are more aware of what is in the waste stream and looking for more ways to remove as much from the disposal stream as possible. Often times, consumers put these plastic containers in their recycling bins regardless of what is actually accepted in their particular recycling program. They may be confused by the chasing arrows triangle on the container/lid, or just assume all plastics are the same and should be in the recycling bin.

Many MRFs (materials recycling facilities) have experimented with marketing these additional plastic containers in order to avoid disposing of them at disposal rates. The high cost of oil resulting in a corresponding higher cost for virgin resin feedstock has prompted domestic reclaimers to look at this material for processing as an alternative feedstock to higher priced resins. The export market has been accepting and reclaiming this material for a number of years and uses it in the manufacture of many products. In short this is a relatively new, developing plastic recycling market. As was the case with HDPE and PET in earlier years, generating critical mass and establishing the infrastructure for recycling these additional plastic containers will be critical in seeing the industry to fruition. Many single stream MRFs and community recycling programs are contributing to the development of this new recycling market. Eco Maine in Portland and St. Georges Island are two Maine communities experimenting with collecting and marketing these materials.

The Association of Post-Consumer Plastics Recyclers is forming a committee to address the issues and opportunities of expanding recycling to non-bottle rigid plastics. The recycling of these commodities is expected to grow and develop as demand and supply increase. Please refer to Appendix E for plastic container specification sheets, as provided by a broker/reclaimer.

Plastic Films

Over the past year or so there have been many news articles about bans on plastic bags, plastic bag recycling promotions, plastic bag usage fees and alternatives to plastic bags. Whereas plastic bags have been actively recycled at chain grocery stores for a number of years, there is a new push to encourage recycling them due to the increased consumer environmental awareness. Plastic bags have been one focus because of their prolific use and visibility as litter.

For years, the composite lumber industry has used plastic bags as feedstock for their decking products. Trex, AERT, and International Paper are a few companies that purchase plastic film as feedstock for composite decking. In addition to retail and grocery bags, they may use stretch film and other clean film streams commercially generated. For the most part, consumers, or community residents are mostly dealing with plastic retail/grocery bags. There are some successful curbside and/or residential plastic bag collections. Rhode Island successfully recycles plastic bags from their MRF collections.

Maine has a statute on their books regarding plastic bag recycling developed by the Maine Retail Grocers Association:

38 MRSA §1605. Plastic bags; recycling

A retailer may use plastic bags to bag products at the point of retail sale only if the retailer:

1. Location. Locates inside the store or within 20 feet of the main entrance to the store a receptacle for collecting any used plastic bags; and
2. Recycles. Ensures that the plastic bags collected are recycled or delivered to a person engaged in recycling plastics.

SECTION HISTORY 1989, c. 585, §E35 (NEW). 1991, c. 475, §1 (RPR).

<http://janus.state.me.us/legis/statutes/38/title38sec1605.html>

If all retailers were in compliance with this statute, recycling plastic bags would be available to everyone who chooses to use them. The key is to make sure recycling bins are available at retailers that choose to use plastic bags, maintained properly and consumers are educated on the importance of using available recycling bins for managing the plastic bags they use.

The American Chemistry Council Plastics division has sponsored a website that provides general information on plastic bag recycling, resources and information about plastic bag recycling programs and where to recycle plastic bags. That website is www.PlasticBagRecycling.org

Boat Wrap Recycling

There have been some successful boat wrap recycling programs in New England and New Jersey. These programs require cooperation between the stretch wrap supplier, boat yard owner and collection vendor to coordinate all aspects of these programs. The 'pressure point support plastic' has to be compatible with the stretch film in order to be marketable. There needs to be a simple single collection strategy over a wide collection area to capitalize on marketability. Because this is a seasonal collection opportunity, early planning and prior market research and gathering full support of the possible 'suppliers' is necessary to avoid an unsuccessful project.

<http://www.wastecap.org/wastecap/Programs/shrinkwrap/shrinkwrap.htm>

A REVIEW OF STATE AND LOCAL OPTIONS TO STIMULATE AN INCREASE IN THE RECYCLING OF PLASTICS

The state has placed the responsibility of providing solid waste disposal services upon municipalities (38 MRSA, §1305). The state established the Waste Management Hierarchy (38 MRSA §2101), which places a higher value on recycling as opposed to disposal of municipal solid waste, and set the statewide recycling goal of 50%. In addition, the state has provided over \$12 million in cost-sharing grants to municipalities to aid in establishing or expanding recycling programs since 1991.

Where the state's solid waste management policy, expressed through the hierarchy, places greater value on recycling than on disposal, and that recycling effectively diverts materials and products from disposal facilities, implementation of recycling programs to increase the capture and providing those items to manufacturers is appropriate.

As part of its annual review of municipal solid waste and recycling programs, the State Planning Office collects financial data from the programs, and uses that information to aid in calculating average program expenses and revenues. The average cost for a municipality to provide solid waste disposal services (including collection, consolidation, transport and disposal) and offer recycling services (including collection, processing and marketing), is quite similar, ranging from \$90 to \$110 per ton. When the revenue received from the sale of recyclables is considered, which varies from material to material, the cost of providing recycling services drops below that of managing those materials as 'waste'. For example, in 2008, HDPE pigmented plastic, when baled, commanded a value of over \$500 per ton, corrugated cardboard had a value of over \$120 per ton, newsprint value was \$115 per ton - - these revenues definitely improved the economics of recycling when compared with disposal. Even those these values moved off their high during the last quarter of the year, with values of over \$25 per ton, recycling still was justifiable.

The benefits of increased recycling include: a reduction in the amount of solid waste requiring management and disposal; reduction in greenhouse gas emissions (recycling typically releases 15 to 25% less emissions as compared to using raw materials for manufacturing); recycling creates more jobs and supports more industrial operations than disposal does; and conservation of water, energy and natural resources, when compared with using raw materials.

In reviewing the potential costs and benefits of recycling an increased volume of plastics, the actual expenses of adding additional types of plastics could not be readily extracted from the recycling program data available, since recycling collection and processing is largely performed as a single activity, and not separated by recyclable item or product.

Options that the state could undertake to stimulate an increase in the recycling of plastics include:

- Expand education and outreach efforts on the value of recycling plastics
- Provide financial incentives to assist with local recycling program development and expansion
- Consider further expansion of Maine's bottle bill program
- 'mandate' recycling (but that raises a number of issues and concerns)
- ban the disposal of selected bottles or containers

During the summer of 2007, a project undertaken by the State Planning Office focused on identifying factors that influence residential recycling rates in Maine at the municipal level. One of the primary questions this study sought to explore was whether municipal recycling success is influenced more by nature or nurture—in other words, is recycling influenced more heavily by demographic factors or by municipal policies that seek to promote recycling?

First, the results of this study suggest that the simplest and most effective way to establish a successful recycling program is to accept as many different recyclable materials as possible. This is the 'sine qua non' of recycling programs. Quite simply, a town cannot have a truly successful recycling program without accepting a wide variety of materials. It is also helpful for municipalities to create venues for re-use, which is in fact preferable to recycling on the waste management hierarchy and can make a big difference in recycling rates.

Beyond this simple step, the results of this study indicate that there are many different paths a town can take in order to achieve a successful recycling program:

- An established ordinance on solid waste and recycling appears to be common in towns with high recycling rates, but the case studies suggest that in many towns having an ordinance does little to actively promote recycling, either because the ordinance only mentions recycling in passing or because the ordinance is rarely enforced. An exception, of course, would be a town that actually enforces its ordinance in a systematic fashion.
- While the statistical relationship between recycling committees and recycling rates is not overwhelming, the anecdotal evidence certainly supports the idea that such committees can have very positive effects on local recycling efforts. In addition to the education and promotion that these committees usually provide for the recycling program, committees can also be instrumental in establishing new recycling policies and features; for example, in one community, the committee helped to install silver bullets and recycling bins around the town.

- Adoption of municipal policies like curbside recycling, mandatory recycling, and 'pay as you throw' programs may help individual towns, but none are by any means required in order to have a successful program. On its own, curbside recycling should not be expected to produce a successful recycling program, although it will likely increase municipal recycling rates (as has been seen in some communities) and may serve as a good complement in a town with a variety of accepted materials and venues for bulky recycling.

The fact is that many of the better recycling programs in the state do not have curbside recycling and that many towns with curbside recycling have unimpressive rates. Many towns simply have enthusiastic and committed residents that do not require much encouragement; the statistical data supports the hypothesis that this is partially a function of demographic factors like education, income, and population size. A simple drop-off program with a wide variety of accepted materials is often sufficient for high recycling rates, especially in wealthy, educated towns of moderate size.

Conversely, many towns with curbside recycling do not have impressive rates. One possible reason for this may be that curbside recycling generally does not address bulky waste and recycling, which makes up a very large portion of the waste stream. Thus, if a town provides curbside pickup for household recyclables but does not recycle bulky materials at all, it may still have a very low rate. Furthermore, curbside may make recycling more convenient, but overall success is still heavily influenced by the variety of materials accepted. If a town has curbside pickup but does not accept a variety of materials, it should not expect to achieve a high rate.

As some communities have found, even with curbside recycling services, such as single sort or single stream, a high number of accepted materials does not guarantee a high recycling rate - - the program may be affected by demographic factors that discourage recycling (large number of apartments, relatively low income and education levels). Thus, while curbside recycling is probably useful in increasing household recycling rates, it is by no means a guarantee of a successful program, nor is it necessary to achieve a successful program in many towns.

As for mandatory recycling, it may be worthwhile as a symbolic measure, but should not be expected to produce substantial results unless seriously enforced. Although there was not enough statistical evidence to reach any definite conclusions on PAYT, such programs do appear to be useful in efforts to reduce the amount of waste produced and increase recycling of small household items, and when combined with other policies are likely to be very effective.

In sum, while it is clear that recycling is influenced by relatively fixed demographic factors like education and income, the main factor appears to be the variety of materials accepted by the municipality. Regardless of demographic factors, increasing the variety of materials accepted tends to have a very positive effect, and establishing an ordinance, curbside recycling, a recycling committee, or adopting PAYT may have a positive impact as well given on the individual town's circumstances.

FINDINGS & RECOMMENDATIONS

There are a variety of options available to the state and municipalities in encouraging an increase in the recovery and recycling of plastic containers:

- 1) increase education and awareness efforts of recycling with an emphasis on plastics
- 2) establish a committee to assist with promotion of its recycling program
- 3) make it 'easier' for residents to recycle: simplify the drop-off area; increase drop-off opportunities for plastics; adopt 'single stream/ single sort' recycling collection
- 4) expand the number or type of plastic containers being accepted
- 5) encourage regionalization of recycling programs, building upon 'economies of scale' for managing plastics and other recyclables
- 6) enact an ordinance requiring recycling
- 7) adopt a financial incentive, such as 'pay as you throw' programs, that places a fee on the disposal of waste but not on recyclables
- 8) explore possibility of adopting minimum recycled content legislation or state purchasing guideline for plastic products, such as has been done with paper products
- 9) provide financial incentives, such as grants and cost-sharing, for expanding recycling programs; or disincentives, such as the banning of certain products from the waste stream, directing them to be recycled instead

The cost of managing additional plastics is going to be largely dependent upon the current recycling collection and processing system. Adding PET plastics to a drop-off recycling program can be done, but the baling of the PET containers is more time consuming than baling of HDPE containers, because of the resin's 'memory' – it doesn't stay crushed as easily as HDPE does. Going with offsite processing of recyclables removes that from the local program, and places that the receiving facility. Most MRF's have balers able to handle PET, or even the mixed (numbers 3 through 7) containers, so processing doesn't necessarily have to be a deterrent.

Curbside collection of recyclables is done typically in one of two ways: recyclables are placed out at the curb and the truck operator separates the recyclables into specific bins on the truck, keeping the materials sorted; or the recyclables are collected 'co-mingled', as with the 'single sort' or 'single stream' collection method. With the 'sorted' collection system, the recyclables are delivered to a processing facility and managed separately, whereas with the co-mingled collection, the processing facility receives the mixed recyclables and must separate the materials. Costs vary greatly between the two collection systems, as well as within each system. Variables such as number of stops, frequency of collection, number of participants, types of recyclables accepted, and other factors influence the actual collection cost.

Just as the design of the recycling program needs to take into account the overall solid waste management system in place within the community, so should the method of increasing plastics recycling meld with the recycling program. The addition of other plastic products needs to be planned so that the collection, processing and marketing of these new plastics does not burden or reduce the effectiveness of the current program.

As municipalities consider possible methods of increasing the capture and recycling of plastic containers from their waste stream, they should not overlook the value of increasing paper recovery and improved management of organics. By fully addressing the components of the waste stream in their recycling program, reaching the state's 50% recycling goal becomes attainable.